

**Summary of SAFARI Gas Instrument Calibrations
(UW Flights 1810-1840: 10 Aug-18 Sept 2000)**

TECO 43S Pulsed Fluorescence SO₂ analyzer

UW Flights 1810-1814 (10 Aug-15 Aug):

Instrument was configured with a 200 ppbv range and 2 minute averaging time.

$$SO_2 [ppbv] = 40.5(volts) - 1.6$$

$$standard\ error\ (\sigma) = 2\%$$

UW Flights 1815-1840 (17 Aug-18 Sept):

Instrument was configured with a 100 ppbv range and 2 minute averaging time.

$$SO_2[ppbv] = 1 + \frac{(180-1)[volts - [3.7 \times 10^{-2} + 7.2 \times 10^{-4}(tstatr) - 4.2 \times 10^{-6}(pstat)]]}{[3.7 + 1.7 \times 10^{-2}(tstatr) + 3.6 \times 10^{-4}(pstat)] - [3.7 \times 10^{-2} + 7.2 \times 10^{-4}(tstatr) - 4.2 \times 10^{-6}(pstat)]}$$

$$standard\ error\ (\sigma) = 7\%$$

where “volts” is the voltage output of the TECO 43S (in volts).

where “tstatr” is the static air temperature measured by the reverse flow thermometer (in °C).

where “pstat” is the pressure measured by the Rosemount Model 830 BA (in mb).

TEI Model 49C UV Absorption O₃ analyzer

UW Flights 1810-1840 (10 Aug-18 Sept):

Instrument was configured with a 60 second averaging time, 1000 ppbv range, and automatic pressure and temperature corrections.

$$O_3 [ppbv] = -0.7 + 94.5(volts)$$

$$standard\ error\ (\sigma) = 1\%$$

where “volts” is the voltage output of the TEI 49C (in volts).

LI-COR LI-6262 Infrared Correlation Spectrometer CO₂ analyzer

UW Flights 1810-1840 (10 Aug-18 Sept):

Instrument was configured with 1 second averaging time, a 1 ppmv range, and a metal bellows pump pulling sample air through the instrument.

$$CO_2[ppmv] = 1 + \frac{(205-1)[volts - [8.2 \times 10^{-1} + 1.4 \times 10^{-2}(tstatr) - 4.5 \times 10^{-4}(pstat)]]}{[1.4 + 5.6 \times 10^{-3}(tstatr) + 5.9 \times 10^{-7}(pstat)] - [8.2 \times 10^{-1} + 1.4 \times 10^{-2}(tstatr) - 4.5 \times 10^{-4}(pstat)]}$$

standard error (σ) = 15%

where “volts” is the voltage output of the LI-COR LI-6262 (in volts).

where “tstatr” is the static air temperature measured by the reverse flow thermometer (in °C).

where “pstat” is the pressure measured by the Rosemount Model 830 BA (in mb).

TECO Model 48 Infrared Correlation Spectrometer CO analyzer

UW Flight 1816 (18 Aug)

Instrument range malfunctioned: no measurements

UW Flights 1810-1815 (10 Aug-17 Aug) and UW Flights 1817-1818 (20 Aug):

Instrument was configured with 2 ppmv range and 10 second averaging time.

$$CO [ppbv] = 362.0(volts) - 1.7$$

standard error (σ) = 3%

UW Flights 1819-1822 (20 Aug-24 Aug):

Instrument was configured with 2 ppmv range and 10 second averaging time.

$$CO [ppbv] = 5 + [(1424-5)(volts + 1.2 \times 10^{-1}) / (5.6 \times 10^{-1} + 1.2 \times 10^{-1})]$$

standard error (σ) = 7%

UW Flights 1823-1840 (29 Aug-18 Sept):

Instrument was configured with 2 ppmv range and 10 second averaging time, and the zero was raised to reduce noise at low concentrations.

$$CO [ppbv] = 5 + [1424-5](volt-.4) / (1.3-.4)$$

standard error (σ) = 21%

where “volts” is the voltage output of the TECO Model 48 (in volts).

Monitor Labs Model 8840 Chemiluminescence NO/NO_x analyzer

UW Flights 1810-1821 (10 Aug-23 Aug):

Vacuum pump not operational : no measurements

UW Flights 1822-1840 (24 Aug-18 Sept):

Instrument was configured with 1 ppmv range and 60 second averaging time, and vacuum pump was operational.

$$NO[ppbv] = 1 + \frac{(1004-1)[volts - [8.3 + 8.3 \times 10^{-2}(tstatr) - 1.0 \times 10^{-2}(pstat)]]}{[5.8 + 1.1 \times 10^{-2}(tstatr) - 4.1 \times 10^{-3}(pstat)] - [8.3 + 8.3 \times 10^{-2}(tstatr) - 1.0 \times 10^{-2}(pstat)]}$$

standard error (σ) = 37%

$$NO_x[ppbv] = 1 + \frac{(1004-1)[volts - [3.7 - 2.0 \times 10^{-2}(tstatr) - 2.1 \times 10^{-3}(pstat)]]}{[8.2 + 2.5 \times 10^{-2}(tstatr) + 5.6 \times 10^{-3}(pstat)] - [3.7 + 2.0 \times 10^{-2}(tstatr) - 2.1 \times 10^{-3}(pstat)]}$$

standard error (σ) = 30%

where “volts” is the voltage output of the Monitor Labs Model 8840 (in volts).

where “tstatr” is the static air temperature measured by the reverse flow thermometer (in °C).

where “pstat” is the pressure measured by the Rosemount Model 830 BA (in mb).

